

A VISUAL GUIDE TO THE U.S. FLEET SUBMARINES
PART TWO: PORPOISE CLASS
1934-1945
(Updated, December 2023)

BY

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By 1933, a very important phase of submarine development in the United States Navy was coming to a close. The fifteen years since the end of the First World War had seen the USN focus its submarine design efforts on the development of the “fleet submarine”. The Navy wanted a submarine capable of running at fleet battle speeds, of being able to scout ahead of the battle line and report on the movements of the enemy, and then conduct attacks aimed at whittling down the enemy in preparation for the main battleship engagement. It was understood that the recently completed S-class boats, although much more capable than any of the preceding classes, would not be capable of filling this new role. A whole new design would be needed.

The V-class that grew out of this requirement (see Part One of this series) were generally not satisfactory (some were abject failures). However, the era of their development proved to be a very important one to the future of the USN submarine force. The designers had made a lot of mistakes, but they had learned from them. The V-boats had shown what worked and what didn’t and those lessons were applied to subsequent development. The learning curve would remain comparatively steep until 1940, but when combined with the maturation of the U.S. industrial base solid progress could now be made.

The genesis of what would become the next step of fleet submarine development, the *Porpoise* class, was the National Industrial Recovery Act of 1933. The NIRA sought to jump start the Depression ravaged economy by allocating government funds for numerous industrial projects. A last-minute change to the bill appropriated \$238 million dollars for the purchase of ships and aircraft for the armed forces. The Navy immediately jumped on this opportunity and allocated a portion of its share to the construction of four submarines for Fiscal Year 1934.

The years between 1925 and 1931 had proved to be a difficult period for the nation’s only civilian shipbuilding company that specialized in submarine construction, the Electric Boat Company (EB) of Groton, CT. During this period they had not produced a single submarine for the U.S. Navy. Lingering acrimony over the S-class engine debacle and their political maneuvering in Congress had put the company figuratively “in the doghouse” with the Navy Department. In addition, the company barely survived the dearth of warship building brought on by international treaties and political retrenchment. They clung to life by building everything from printing presses to fish skinning machines, and by building small civilian ships and four submarines for the Peruvian Navy at their new building yard on the Thames River in Groton. Acting mostly as a design firm, all of their previous submarines had been subcontracted out to other shipyards like Bethlehem San Francisco on the west coast and Bethlehem Quincy in Massachusetts. With the passage of time the acrimony directed at EB faded, and desirous of having a second design and construction source (other than government owned yards) the Navy awarded the construction of the last V-boat, USS *Cuttlefish* (SS-171) to EB in 1931 and allowed them to inject some of their own design expertise into the process. EB’s tinkering with the design and their expanded use of the new process of

welding on *Cuttlefish* highly impressed Navy officials and put them in a good position to bid on new contracts for the FY-34 boats, to be called the *Porpoise* class

The Navy's lead submarine design authority resided at the Portsmouth Navy Yard in Kittery, Maine and the naval architects and ship fitters there were highly distrustful of welding due to the newness of the process and the potential impacts to the yard's workforce. They made a strong case to stick with the tried and true method of riveting. Debate was rife for several months, but in the end the Navy decided the matter via a split decision. For the FY-34 program, two boats were awarded to Portsmouth, to be built to an enlarged version of the previous *Cachalot* (SS-170) design (itself a refinement of the pioneering *Dolphin*) with a traditional riveted full double hull. EB was also awarded two boats, to be built to a radically different all-welded partial double hull. However, all four boats had the same armament, propulsion machinery, and operating characteristics and were very similar in external appearance.

The EB design wound up being the better of the two. The full double hull of the Portsmouth design proved to be difficult to maintain in the narrow confines at the very ends of the boat and corrosion proved to be a big problem in these areas. The Navy received funds for six boats for FY-35 and quite impressed with EB's new hull form they ordered repeats of the EB partial double hull. The welding of the two EB boats was entirely successful and the Navy wanted all subsequent submarines to be welded. Portsmouth remained somewhat intransigent on this issue and insisted that they could not yet make the shift to welding. Thus, the two boats awarded to Portsmouth in the FY-35 program (along with a third given to Mare Island Navy Yard in Vallejo, CA), even though built with the partial double hull pioneered by EB, were the last riveted submarines built for the U.S. Navy.

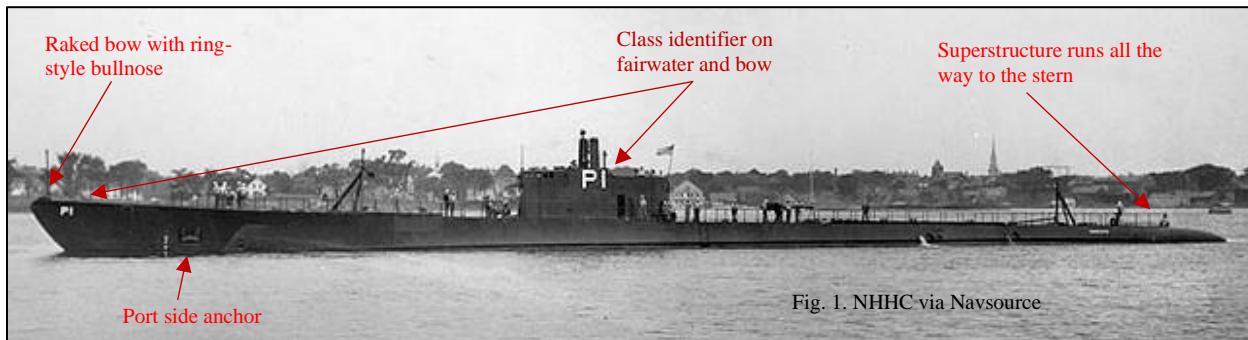
Visually, these ten submarines continued the tone pioneered by the preceding *Dolphin*, *Cachalot*, and *Cuttlefish* and firmly entrenched the "fleet submarine look" in the eyes of the public and the Navy. These design elements (with relatively minor changes) were continued all the way to the original configuration of the *Gato* class of 1941-42, giving way to substantial modifications only when the exigencies of combat dictated new configurations. However, these boats had enough distinctive features to enable their visual identification and separation from other classes.

ORIGINAL CONFIGURATION

PORPOISE AND PIKE

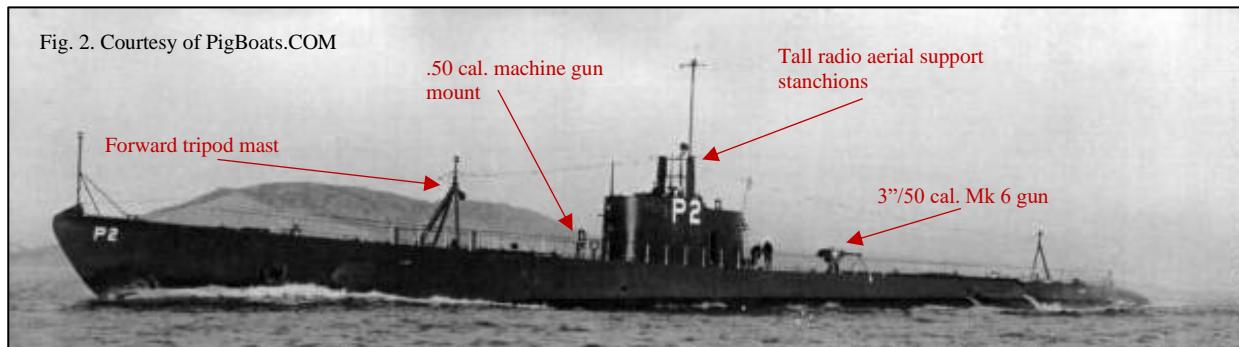
The two Portsmouth built boats of the FY-34 group, *Porpoise* (SS-172) and *Pike* (SS-173) were built to the traditional full double hull design, although this made little difference visually while the boat was surfaced. By the time these boats hit the water, the Navy had standardized on a flat black paint scheme for all submarines, and these were the first boats built in black paint. At first glance these boats would appear to be nearly identical to the *Cachalots* as they shared many of the same features. However, *Porpoise* and *Pike* were nearly 30 feet longer, a design accommodation that allowed the addition of two additional main engines. These were also the first boats with all-electric drive, a propulsion arrangement where the main engines only drove generators and were not directly connected to the propeller shafts. Actual propulsion was provided by electric motors, which used the electricity produced by the diesel generators when surfaced, or by the massive storage batteries when submerged.

Class leader *Porpoise* is shown here (Figure 1) shortly after her commissioning in 1935. She has a sharply raked bow with an above deck circular towing fairlead (or “bullnose”) right at the tip of the bow.

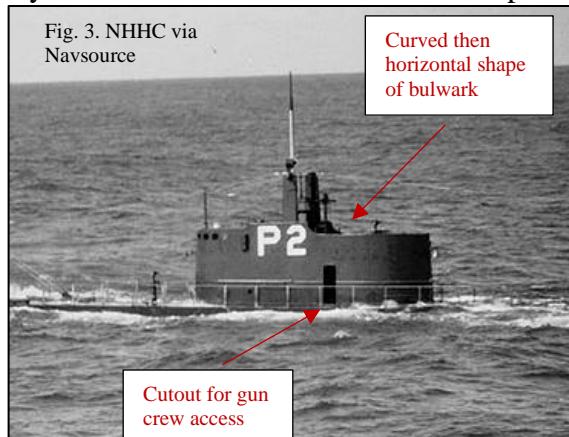


At full load these boats sat low in the water, and when the bow planes were rigged out they were already submerged in the water. One of the two anchors can be seen just forward of the port bow plane. The superstructure runs aft smoothly from the bow planes, unbroken all the way to the stern where it is faired into the outer hull. This feature helps distinguish these boats and their follow-on sisters of the *Salmon/Sargo* class from the later *Tambor/Gar & Gato* classes, which had the aft superstructure end short of the stern.

All ten of the *Porpoise* class boats carried the letter/number class identifiers on either side of the bow and fairwater until early 1939 when they were replaced with the boat's hull number. *Porpoise* was P1 and each boat was numbered sequentially, with *Pompano* carrying P10. These letter/numbers are not the boat's name and do not appear on any official Navy documents as such. They were intended as an expedient for long range visual identification only.



Pike is shown Figures 2 and 3 circa 1936 and 1938. On the forward deck is a prominent tripod style mast that was the forward anchor-point for her long-range radio aerial wires. These wires ran



from this mast up to two support stanchions on each side of the conning tower fairwater, and then back down to the aft deck to a similar but smaller mast. Communications were supplemented by an extendable radio mast just aft of the bridge and the aerial stanchions. Immediately aft of the aerial stanchions the upper edge of the fairwater bulwark curved sharply downward to the horizontal, then ran aft forming the guard rail around the so-called “cigarette deck”. Both *Porpoise* and *Pike* are carrying the 3"/50 caliber Mk 6 gun mount aft of the conning tower fairwater, standard practice of the

time. This mount was a surface action only single purpose mount, its relatively short height keeping the gun close to the deck and thus preventing high angle fire. This is in contrast to the later Mk 11, 17, and 18 mounts (introduced on the *Tambor* class of 1940), whose taller pedestal allowed high angle anti-aircraft fire. The gun crew exited the interior of the boat via a water-tight door in the aft end of the horizontal pressure-proof cylinder of the conning tower and into a void space in the fairwater between the conning tower and the main air induction valve. They then accessed the main deck through a rectangular cutout in the fairwater, seen in Figure 3 just aft of the number 2. As built these boats also carried two water-jacketed M2 .50 caliber machine guns. One gun had a mount on the cigarette deck aft of the bridge and masts, and the other was on the forward deck. The mount pedestals were fixed and remained topside when the boat dived, with the guns themselves being dismounted and taken below.

The major visual distinguishing characteristic of the *Porpoise* and *Pike* was the shape of the stern, which is unfortunately hidden in most photographs. These two boats with their full double hulls carried on the rounded, wrap around stern with a horizontally flat shaped “shovel” tip of the earlier V-boats. The muzzle doors for the two aft torpedo tubes were underneath the stern, and can just be seen in Figure 4, a 15 August 1935 commissioning day photo of a lightly loaded *Porpoise*, sitting high in the water. This design feature was borrowed from submarine pioneer Simon Lake, who favored this stern shape, believing it provided extra buoyancy. *Porpoise* and *Pike* were the last two boats built with this stern. All subsequent boats used a partial double hull with single hull ends, necessitating a complete redesign of the stern into a vertical “chisel” shape.

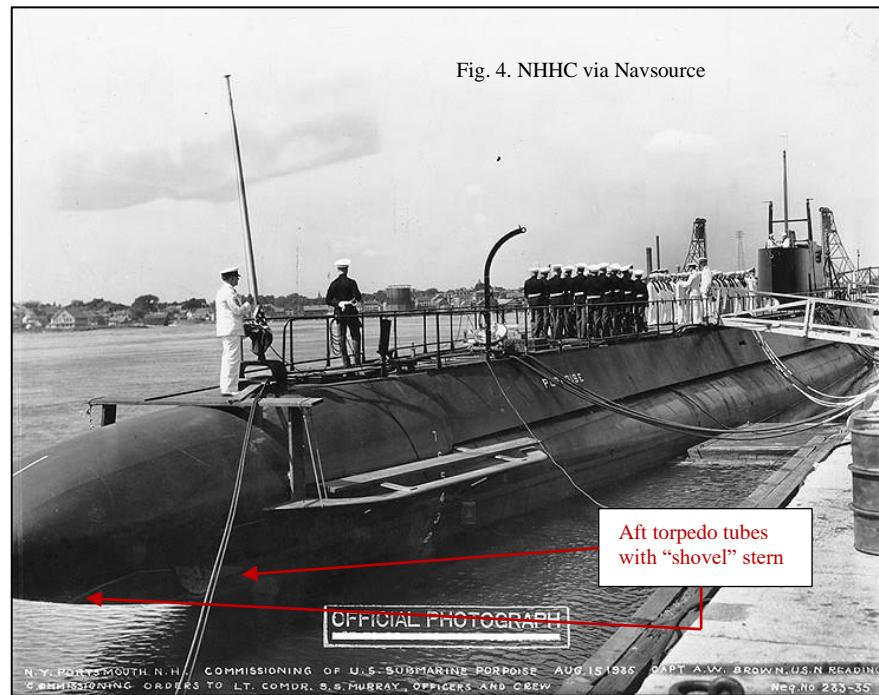


Fig. 4. NHHC via Navsource

Operational experience with the earlier V-boats had shown that the standard 30-foot periscopes were too short, forcing the boat to stay close enough to the surface that it oftentimes broached in even moderate seas. It took until February 1935 for the Navy to issue the specification for longer

34-foot scopes and thus they weren't ready for *Porpoise* and *Pike* and the follow-on FY-34 boats. Therefore, these boats had the older 30 footers installed (Figure 5) and they carried them until the longer units were available and could be retrofitted. When fully raised the forward #1 scope eyepiece was in the conning tower and the aft number 2 scope eyepiece was in the control room. It was found that even these relatively short periscopes vibrated badly when

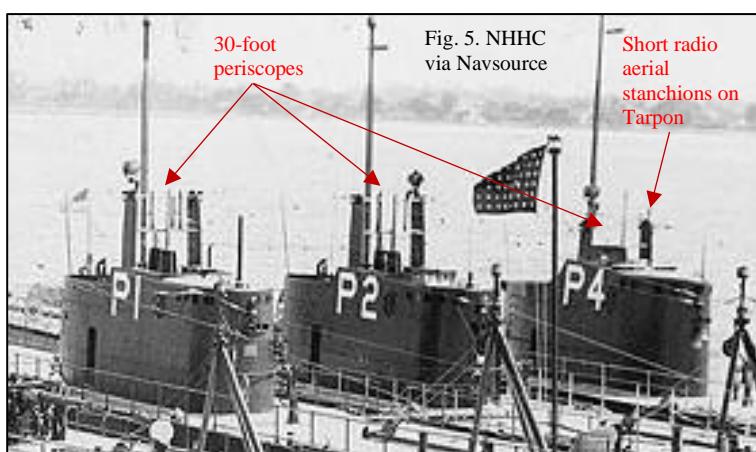
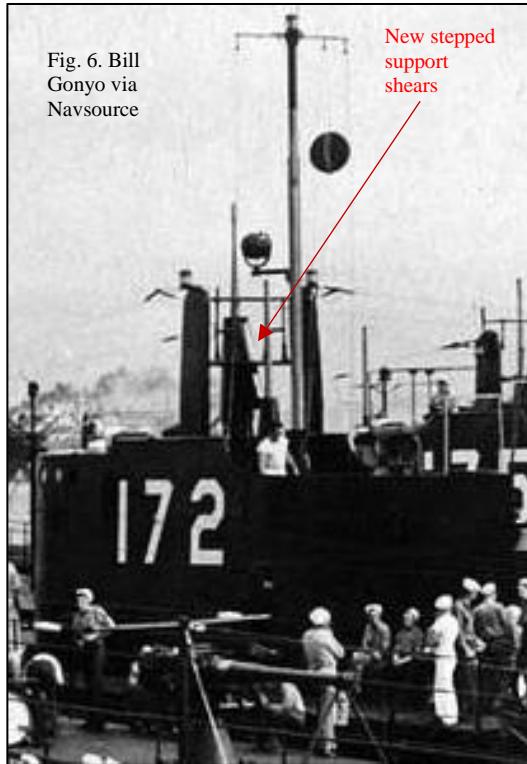


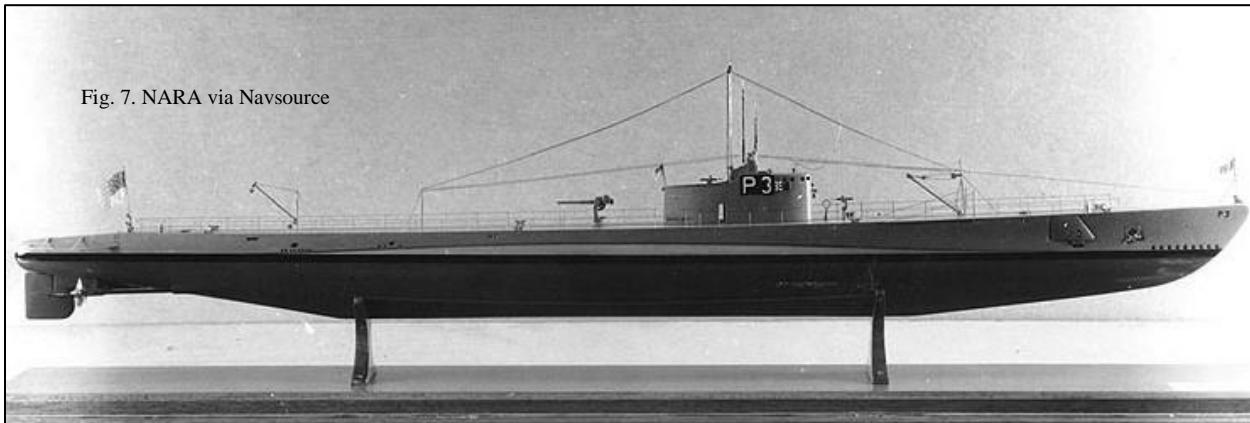
Fig. 5. NHHC via Navsource

raised due to water flow turbulence, blurring the image in the eyepiece. When the longer 34-foot scopes were installed longer fairing shears were added to reduce this unwanted phenomenon. This resulted in the periscope shears having a stepped appearance (Figure 6). In this early 1939 photo of *Porpoise* the shears can be seen between the radio aerial stanchions, with the aft scope just above the head of the Sailor in the white shirt. Because both scopes were 34-footers it required that the boat be very close to the surface when using the control room scope. In many cases it would have resulted in portions of the radio aerial stanchions breaking the surface as well, making it easier for an enemy to see the boat at periscope depth. This tactical liability was corrected during wartime overhauls. Note also that the class identifiers on the side of the fairwater had been dropped in favor of the boat's official hull number, in this case 172. This was a force wide change that affected all submarines and became the standard for all future boats.

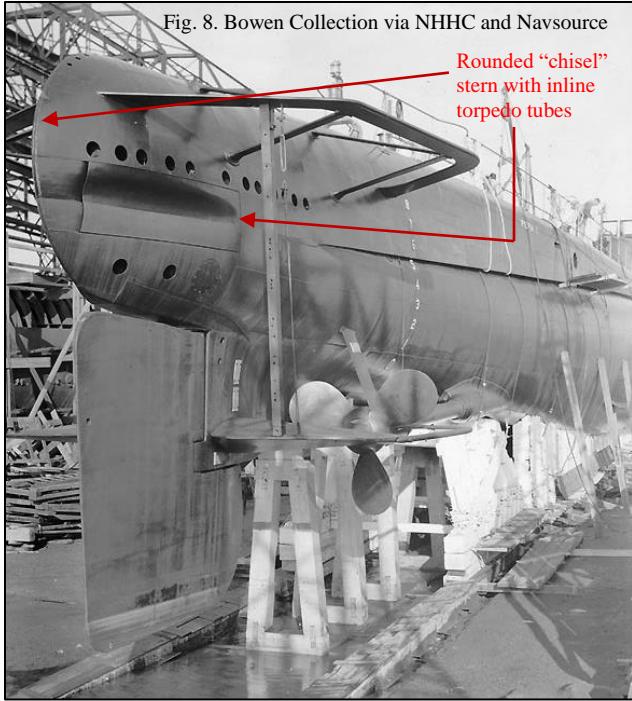


SHARK AND PERCH GROUPS

Departing from the naming convention established with the Portsmouth built *Porpoise* and *Pike*, the Navy named the two boats of the FY-34 group assigned to Electric Boat *Shark* (SS-174) and *Tarpon* (SS-175). Eager to reestablish themselves as a premier submarine builder, EB chose a hull form used on the earlier *Dolphin*. The partial double hull had the pressure resisting interior hull wrapped by the outer hydrodynamic hull, with the main ballast and fuel tanks contained in the void spaces between, but with the outer hull merging with the pressure hull in the areas of the torpedo room bulkheads. This eliminated the narrow and hard to maintain spaces at the forward and after ends of the hull, making maintenance easier. This departure proved entirely successful and it became the standard for all subsequent fleet submarines. The engineering plant, armament, and operating characteristics were identical to the two Portsmouth boats and thus they were considered to be in the same class. The six FY-35 boats were divided amongst EB (*Perch*, *Pickerel*, & *Permit*), Portsmouth Navy Yard (*Plunger* & *Pollack*), and Mare Island Navy Yard (*Pompano*). The FY-35



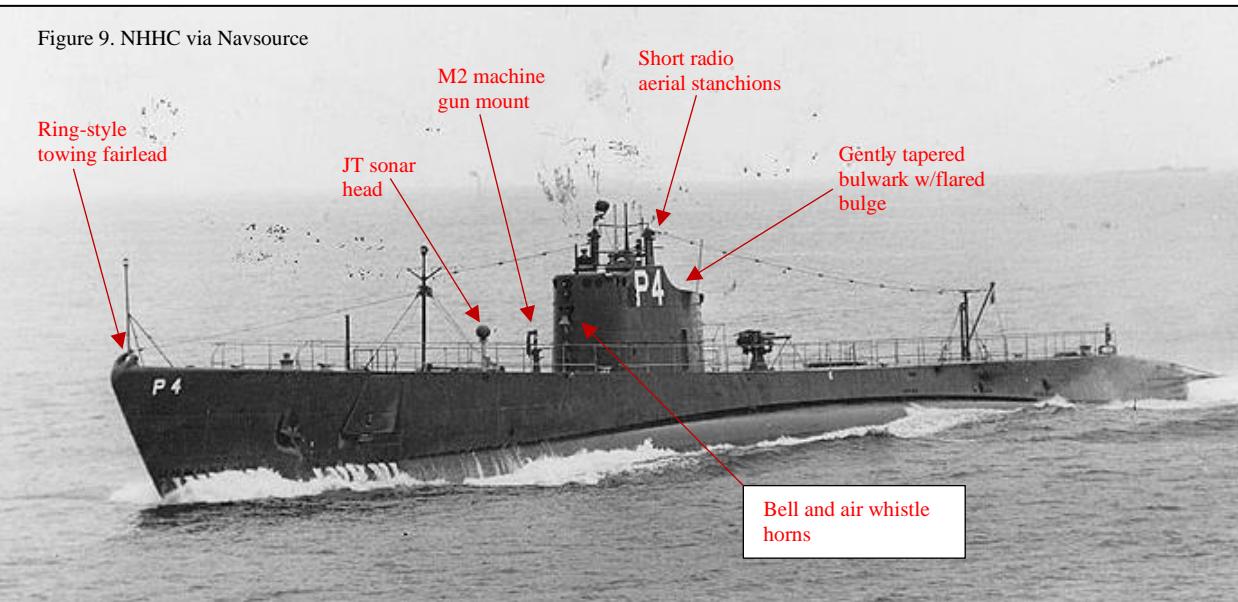
boats were identical to their two EB predecessors except for an additional two feet in length, intended to ease crowding in the engine room. This EB model of *Shark* (Figure 7) gives an excellent overall configuration view of this group, although all of the boats would be painted black instead of the haze gray shown here.



The partial double hull construction is not readily apparent, although the differences in the stern configuration are clear, especially in Figure 8, a prelaunch photo of *Permit*. The two aft torpedo tubes are now in line with the stern instead of below it and instead of the flat horizontal tip it has the rounded vertical “chisel”. Prominently shown are the mine cable guards above and around the three bladed propellers. The holes are for a free flooding space in the superstructure above and below the torpedo tube shutter doors.

The 1937 photo below of *Tarpon* (Figure 9) gives a good view of the as built configuration of the group. The ring type towing fairlead bullnose is at the very tip of the bow. Her port side anchor can be seen (she had another on the starboard side) along with the folded-up bow plane. The ball shaped object forward of

the fairwater is an experimental sonar transducer (probably JT series). It did not consistently appear in the original configuration of these boats and thus was temporary in nature. Just aft of that is the hook-shaped mount for a .50 caliber M2 machine gun. The gun itself was routinely dismounted and taken below when not used, leaving the mount topside. The radio aerial stanchions atop of the



fairwater were shorter for the *Shark* and *Perch* groups. There is a flared-out portion of the upper edge of the cigarette deck bulwark aft of the bridge. This was intended to increase the firing arc of the M2 machine gun mount in this location. *Shark* and *Tarpon* also had the 3"/50 caliber Mk 6 gun on the aft deck. Although not readily apparent in this photo, both of these boats had the same periscopes of the *Porpoise* and *Pike* but their positions were reversed, with the control room scope forward of the conning tower scope. The cone shaped fairing shears had not yet been added when this photo was taken so the lessons on periscope vibration were still being learned by the force. This also indicates that these are the earlier 30-foot scopes, not the later 34-footers. Also seen in this photo is the ship's bell, mounted on the forward edge of the fairwater with the two horns for the pneumatic air whistle directly above the bell. The bell would have normally been dismounted

and taken below prior to diving. Above the whistle horns are circular glass windows letting into the covered pilothouse (also called a navigation bridge) which is below and forward of the open air bridge. The pilothouse contained a steering helm, magnetic compass, and gyrocompass repeater for use on the surface and was free flooding when the boat was submerged.

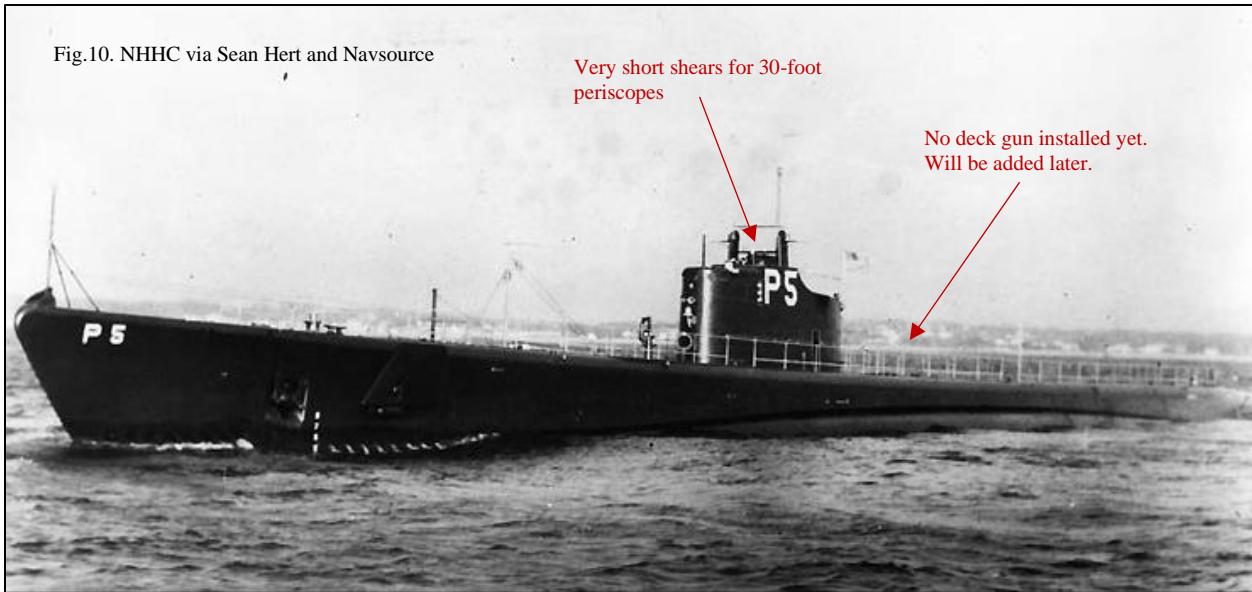
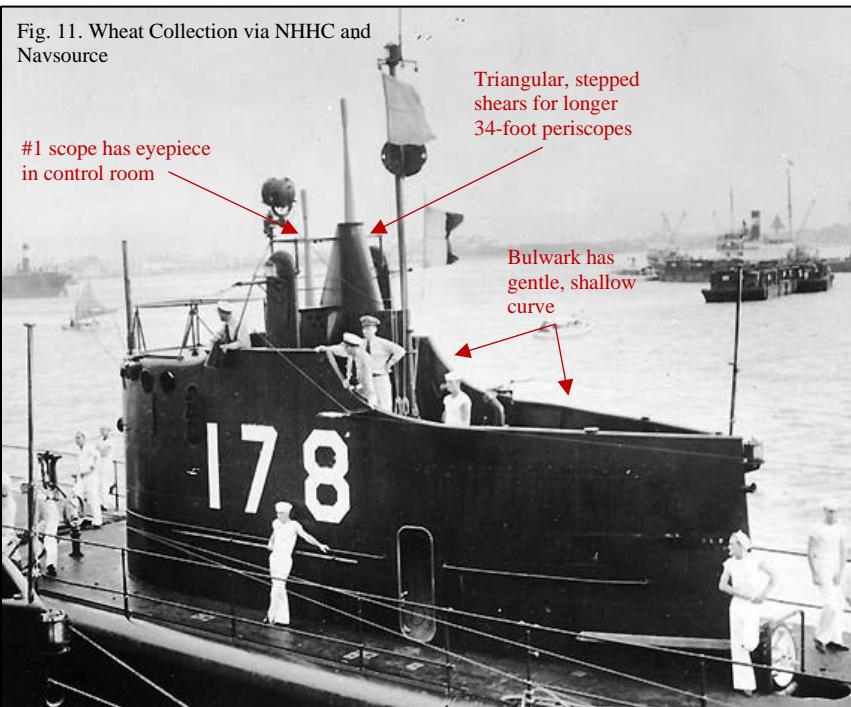


Figure 10 above is a November 1936 shot of *Perch* shortly after commissioning shows a temporary arrangement of her periscope shears. This was the result of production delays of the 34 foot periscopes, making them unavailable for installation at the time. Kollmorgen 30 footers were

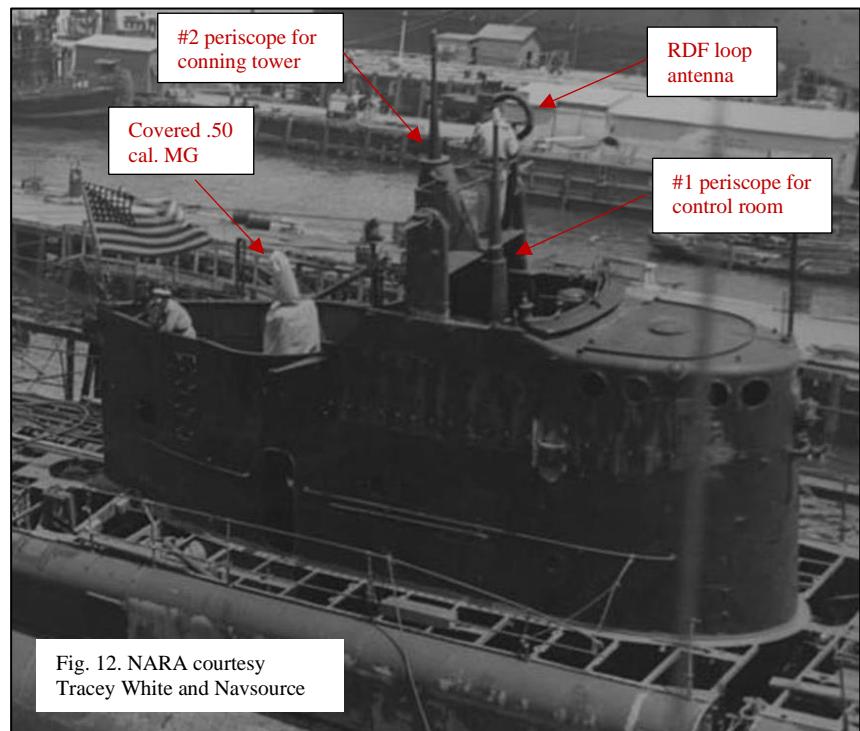
installed until the longer scopes became available. The intended configuration is shown in Figure 11. It is an excellent shot of *Permit's* fairwater in approximately 1939. The cone shaped shear for the aft conning tower scope can be seen above the officer's head, with the shorter shear for the control room scope forward of that. A search/signal light is mounted on the port side aerial stanchion. The bulwark around the cigarette deck has a much more gentle and shallower curve in these boats, seen here right in front of the two officers. The



cigarette deck mount for the .50 caliber machine gun can be seen to the right of the white-hatted Sailor. Forward of the fairwater on the deck is a Radio Direction Finder (RDF) loop antenna that was used to receive long range communications, even at periscope depth. Directly aft of number 2 periscope is an extendable radio mast that doubled as a perch for white masthead navigation light. Above and just forward of the number 1 is the enclosure for the red colored port side running light, and a similar enclosure would be on the starboard side for the green running light. Mounted on the top of the pilothouse is a removable framework for a canvas awning used to deflect some

of the southern California sunshine (this photo was taken in San Diego). A hatch going down to the crew's berthing can be seen right on the centerline immediately aft of the fairwater.

Although an early wartime shot, Figure 12 is a photo of an as-yet unmodified *Plunger* high and dry on the marine railway in Pearl Harbor shows many of the same features. The arrangement of the periscopes can clearly be seen. The RDF loop has been moved to the port side aerial stanchion and the .50 caliber mount is covered by a tarp. The gun was actually mounted in this case, a wartime expedient while in port to provide instant anti-aircraft protection. Most of *Plunger*'s decking has been removed to facilitate work on the interior of her superstructure. Just forward



of the periscopes is the open bridge, used by the Officer of the Deck and lookouts while surfaced. Forward of the bridge is the covered pilothouse. The enclosed horizontal pressure hull of the conning tower is directly below this, completely covered by the whole fairwater enclosure. Notice also how there are no identifying marks. The "P" class identifying marks had been done away with in late 1938, replaced by the hull numbers. But even these were painted out immediately upon the start of hostilities, not to return until the end of the war. This helps in placing a date on most photos.

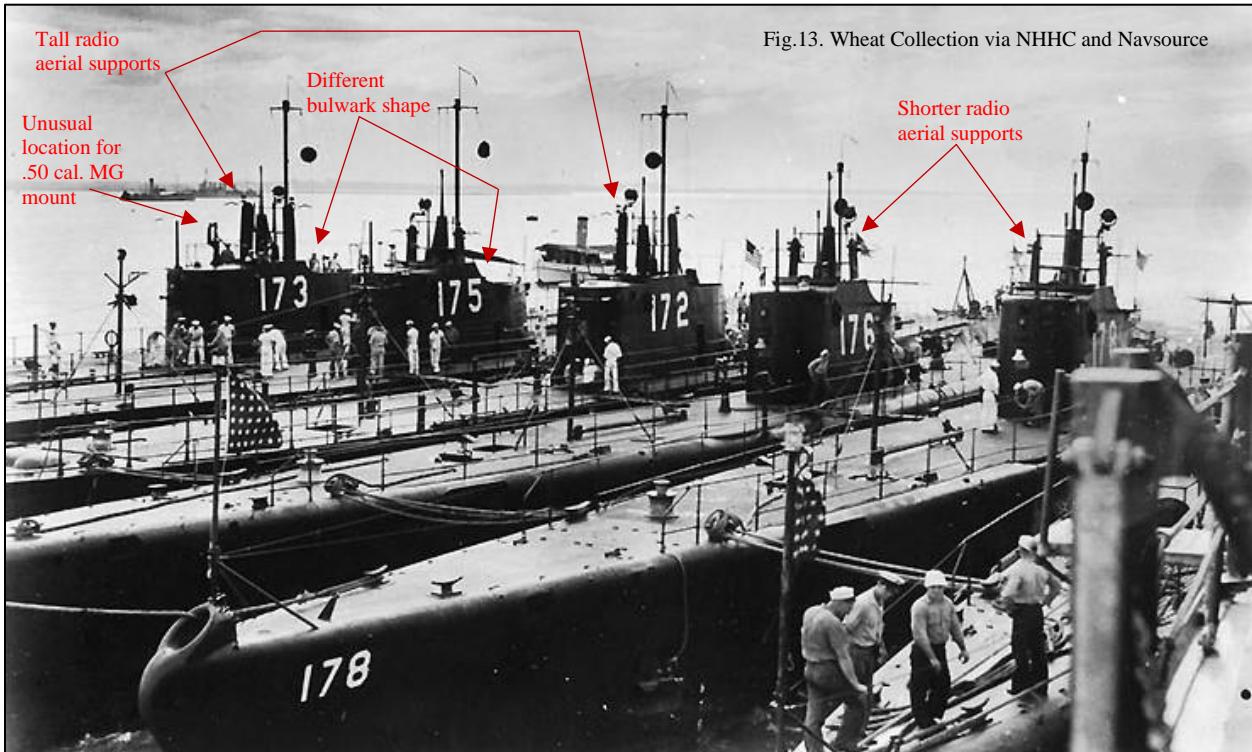


Figure 13 is a 1939/1940 photo of six of the class moored alongside a tender and it gives a good overview of the topside arrangement of the class just prior to the war. Note the difference in the shape of the aft bulwark on the fairwater of the Government built *Pike* (173) and *Porpoise* (172) from the latter EB built *Tarpon* (175), *Perch* (176), and *Permit* (178). Notice the taller radio aerial support stanchions on the top of the fairwater for *Pike* and *Porpoise* compared to the shorter ones for the other boats. Now that the periscopes have the support shears, the radio aerial stanchions are also used to provide further anti-vibration structural support via cross members running from the stanchions to the shears. *Pike* has the forward .50 caliber M2 mount in an unusual location on top of the wheelhouse and the RDF radio loop antenna on the forward deck. The remainder of the boats have both of these features in the standard location on the forward deck. This photo also gives the reader a good impression of how much equipment was topside on these boats giving an appreciation for the amount of drag that it generated while the boat was submerged.

Figure 14 is a closeup of the bow of *Perch* in 1937 and it illustrates a little-known feature of the fleet submarines. All of the boats through the early *Gato* class had swing out mine cable cutters

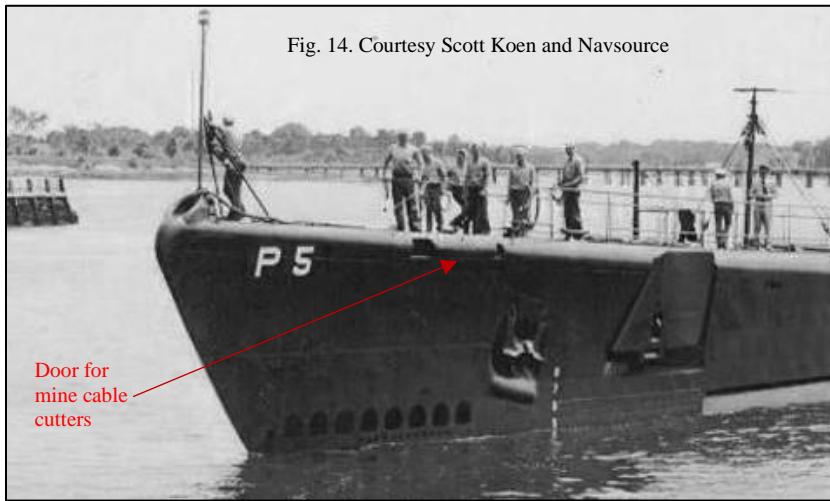


Fig. 14. Courtesy Scott Koen and Navsource

on either side of the bow, right at the upper edge of the superstructure just forward of the anchor. Doors with hinges that swung open upwards covered the cutter arms when they were retracted into the superstructure, and those doors can be seen in this photo. The cutters could only be rigged out while on the surface. The multiple serrated edges sliced the metal mine cable as it passed along the

cutter arm. Photos of the cutters rigged out are extremely rare. There are a few known photos with the doors open, but the arms are still rigged in. The reason for this is not readily known and may have been because the cutters were considered to be classified equipment, or it may be because they simply were not used very much because the crews held them in little regard. There was an obvious reluctance on behalf of submarine crews to knowingly drive their boat into a minefield, and if the presence of the minefield was unknown then the presence of the cutters mattered very little. The only photo that this author has ever seen of rigged out cutters is this one of the *Gato* class *Growler* (SS-215) (Figure 15) taken during her fitting out period at EB on 30 December 1941. The structure below the cutters is temporary construction scaffolding.

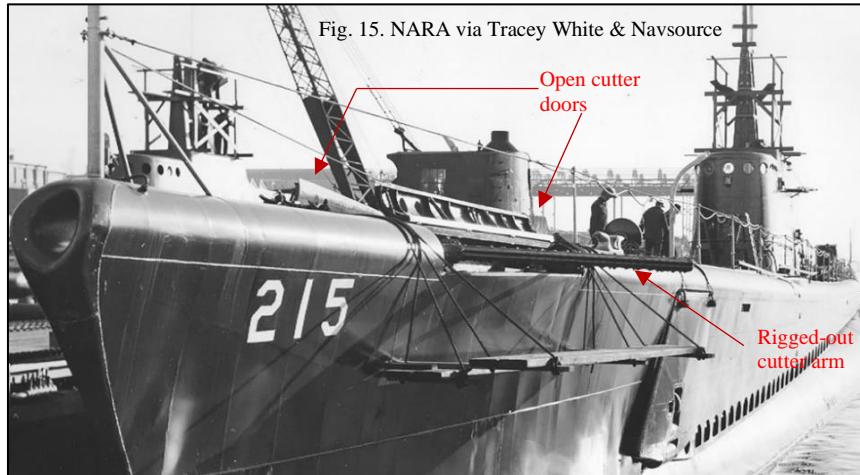


Fig. 15. NARA via Tracey White & Navsource

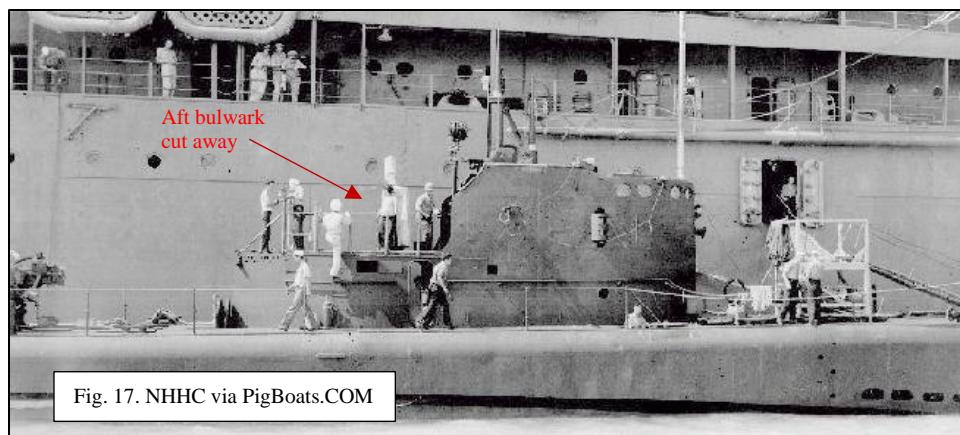
WARTIME MODIFICATIONS

The as-built configuration of these boats had been optimized by their designers for peacetime cruising. Although the boats were fully capable of carrying the war to the enemy from the very start, it became quickly apparent that certain design features that were very useful for peacetime port calls and exercises proved to be at best unnecessary, and at worst liabilities once the actual shooting started. Some of these liabilities had been identified pre-war by forward thinkers within the force, but the low intensity operations of that period provided no impetus or urgency to upgrade. The shocking reality of the war they found themselves facing quickly swept away any objections to putting the boats into fighting trim. Numerous items of equipment both topside and belowdecks were identified as unnecessary or unneeded by the operating forces and a list was quickly submitted to the ongoing Submarine Officers Conference for review. The list was approved with few revisions and forwarded to the Bureau of Ships (BuShips) for approval. With the urgency of war staring them in the face the Bureau moved with uncharacteristic speed and by 01 January 1942 the first of the revisions was promulgated to the force for immediate implementation.



One of the obvious liabilities was the large bulk of the conning tower fairwater (Figure 16). This structure was understood by the operating forces to be too large even before the war, but tradition and bureaucratic inertia had kept it in place. Its bulk gave the boat a large silhouette and made it easy to spot on the surface by the well-trained Japanese lookouts with their excellent binoculars. It had to go. BuShips approved a reduction in size on 09 March 1942, but it is likely that some conversion work was done before that by tender crews goaded into action by anxious submarine crews. Another

factor driving the desire to reduce the fairwater was, with the realization that the boats would be spending more time on the surface than previously thought, a more powerful gun armament was needed. The boats already had a water cooled .50 caliber M2 machine gun mount on the "cigarette deck" aft of the periscopes,



yet this weapon was deemed too light. In order to mount a larger, heavier weapon here the bulwark surrounding the cigarette deck needed to be removed. Figures 17 & 18 show *Plunger* alongside

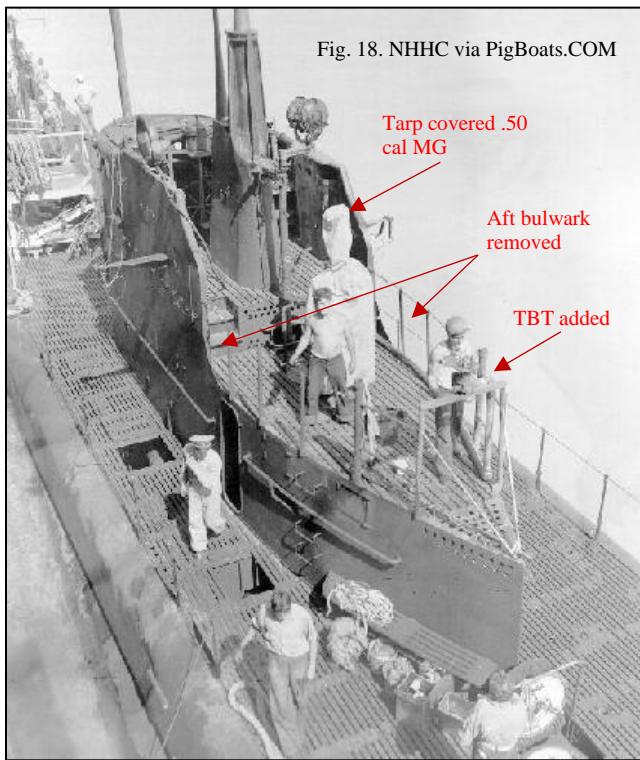


Fig. 18. NHHC via PigBoats.COM

the tender *Fulton* (AS-11) at Midway in July 1942, highlighting an early conversion of this type. The tender crew simply took a torch to the bulwark plating and cut it away down to the deck level. Not only did this lessen the profile but it also greatly increased the firing arc of the gun mounted here, especially against close-in low lying targets like small surface craft. At this point the boat retains the .50 caliber M2 mount and it is covered by a white tarp. A new framework has been erected at the very aft end and on it a Target Bearing Transmitter (TBT) has been mounted. By attaching a set of standard 7x50 binoculars to the cradle, the TBT was used to sight on an enemy craft while making a surface approach and transmit an accurate bearing to the Torpedo Data Computer (TDC) below decks. The RDF radio loop has been moved to a position on the port side of the bridge fairwater and a portion of the plating around

the #2 periscope shear support has been removed. The covered pilothouse is still in place, but most likely the surface steering station has been removed, as it was authorized for removal six months earlier. The pole mast seen at the very front of the pilothouse is most likely a mast for a newly installed SD series air search radar set. The SJ series surface search radar was still a few months away from widespread introduction and in these photos *Plunger* does not yet have it installed. In this configuration *Plunger* is roughly equivalent to a *Gato* class Mod 2A configuration (see Part Four of this series).

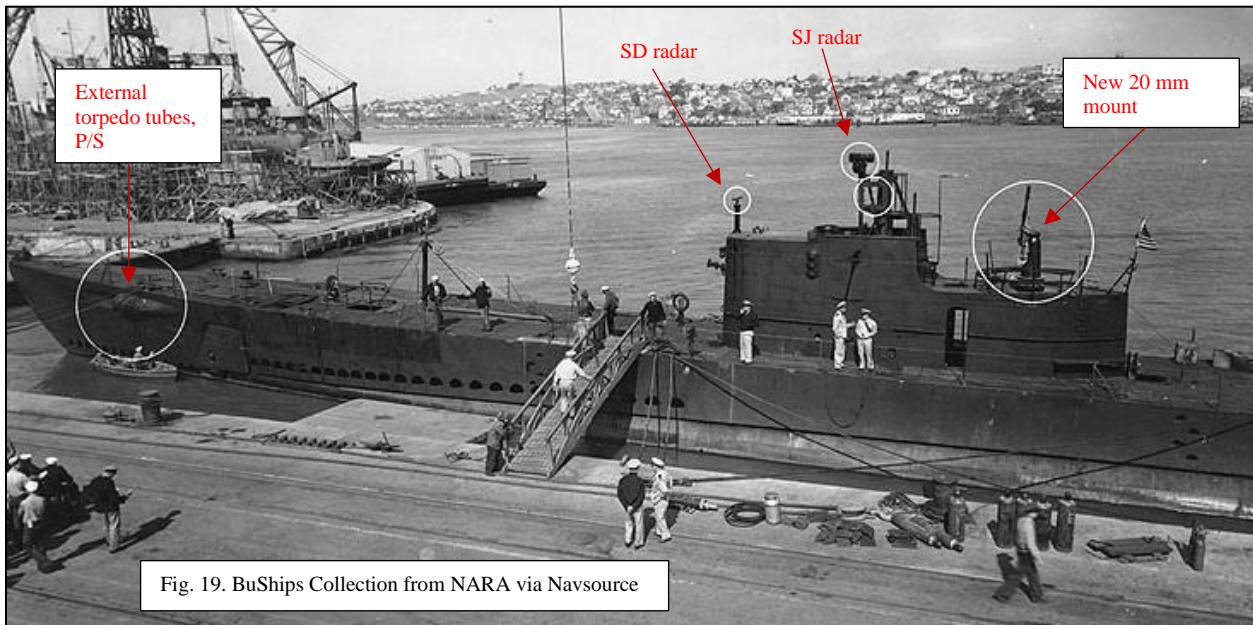


Fig. 19. BuShips Collection from NARA via Navsource

These excellent shots of the *Pike* (Figures 19 & 20) in overhaul at Mare Island Navy Yard in October 1942 show a further development of this Mod 2A equivalent configuration. On the cigarette deck the .50 caliber M2 mount has been replaced by a 20 mm Oerlikon rapid fire cannon

on a Mk 5 Mod 4 mount. This heavier but easy to use weapon gave the boat a good punch against not only aircraft but small surface craft. The height of the solid base Mk 5 mount necessitated that a semi-circular ring stand be installed around it to give the gunner a proper perch. Moving forward there is a newly installed bracket for the SJ radar mast and the mast and dish itself. Not apparent in this photo is the fact that the mast is actually installed on the starboard side of the periscope shears. This was done to allow the #1 periscope, with its eyepiece still letting into the control room

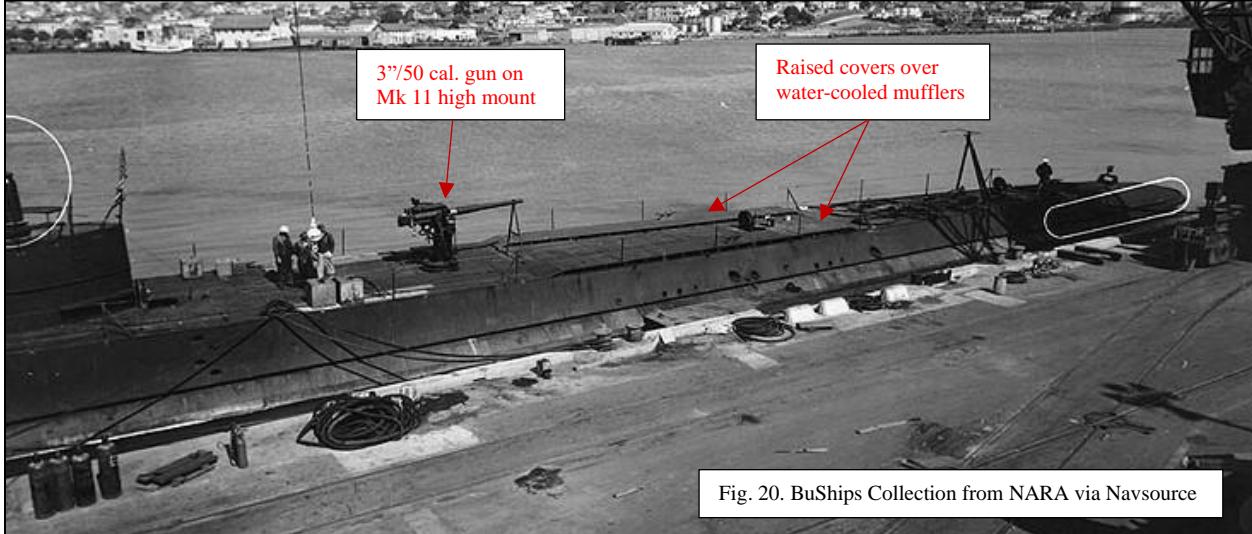


Fig. 20. BuShips Collection from NARA via Navsource

to clear the SJ mast bracket while the scope was being raised and lowered. On the very forward end of the pilothouse can be seen the lowered mast for the SD air search radar. Space restrictions in the relatively small conning tower dictated that the SD set be installed in the control room. This dictated the placement of the mast. In this position the mast passed in front of the conning tower and allowed the cabling to penetrate the pressure hull directly into the control room. This is a unique feature of the *Porpoise* class boats and can be used to identify them in wartime photos. On the aft deck several new features can be seen. The original 3"/50 caliber Mk 6 deck gun has been replaced with a newer model Mk 11 mount. This enabled the gun to obtain a much higher elevation, giving it a nominal anti-aircraft capability. This model of gun is easy to spot with its much taller mount structure. Just aft of the gun are raised platforms that cover new water-cooled mufflers for the main engines. These mufflers not only quieted the boat but they also suppressed flashes and sparks that might be seen by the enemy at night. *Pike* has also received new GM-Winton 12-278A diesel engines, replacing the original 16-201A engines that had bedeviled the crew with frequent breakdowns. Although lower powered the new engines were much more reliable.

As built, the *Porpoise* class submarines had a main armament that consisted of four 21-inch torpedo tubes forward, with two in the after torpedo room. Submarine crews had long wanted a more powerful armament, but doctrine and training in the 1930's argued against it. In the days

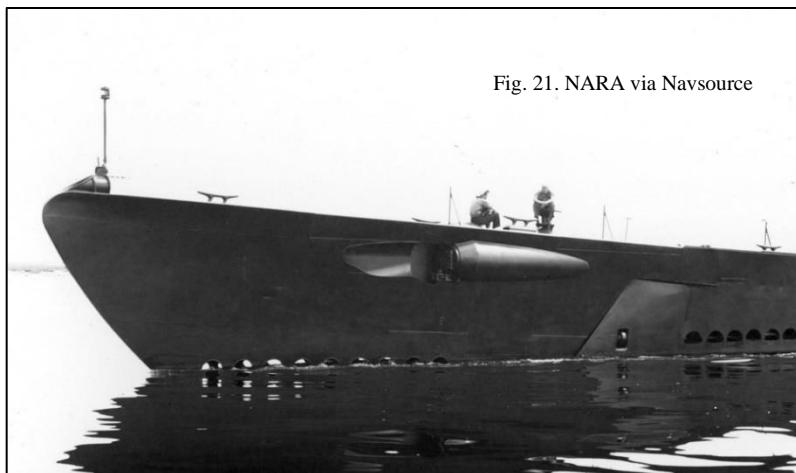


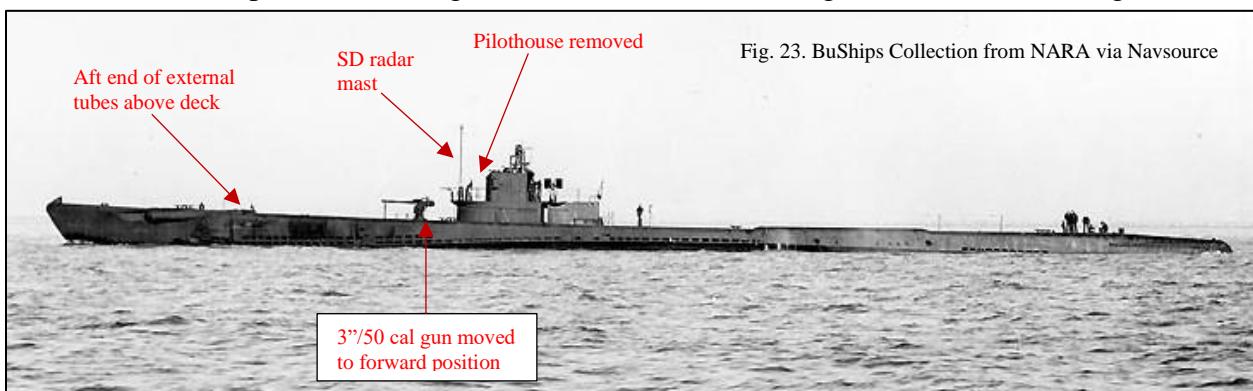
Fig. 21. NARA via Navsource

following Pearl Harbor these outdated ideas were quickly swept away with the efficacy of a greater torpedo salvo fully understood. However, there was no practical way to add internal tubes to boats with only a four tube forward nest. It would have required a complete reconstruction of the forward end of the boat and it would have generated impossible to solve problems with stability. The

British had pioneered the practice of adding additional torpedo tubes external to the pressure hull in the superstructure and this was the solution used by the USN. Thus, during their overhauls in 1942 *Porpoise*, *Pike*, *Tarpon*, *Pickerel*, and *Permit* were fitted with two forward firing tubes in the superstructure just below the main deck forward of the bow planes. The first three boats had the tubes installed in the fashion shown in Figure 21 on *Porpoise*. The tubes were installed parallel to the main deck, but due to the upward camber of the deck in this area it resulted in the tubes having a slight upward angle, which caused the weapons in the tubes to be ejected *towards* the surface when they were fired. Broaching of the weapons and other undesirable behavior was the result. To compensate for this shortcoming the final two boats had a modified installation in which the tubes were canted downward, in essence leveling them in relation to the boat's keel. This resulted in the tubes on *Pickerel* and *Permit* having their aft ends protrude slightly above the deck level giving these two boats a distinctive appearance. In the photo of *Pickerel* on the right (Figure 22) notice the deck covers for the aft end of the tubes just above the bow planes. These tubes seemed to be a good idea at first, but quickly proved to be a liability. The weapons inside the tubes could not be serviced once loaded and thus their reliability after several weeks at sea could not be verified. They were also vulnerable to depth charge damage. The weapons carried in them tended to malfunction at a rate higher than the already unreliable torpedoes and thus their use proved to be heavily disliked by the crews. *Shark* and *Perch* were lost before the tubes could be installed, and *Pollack* and *Pompano* never had them installed for reasons that are not clear.

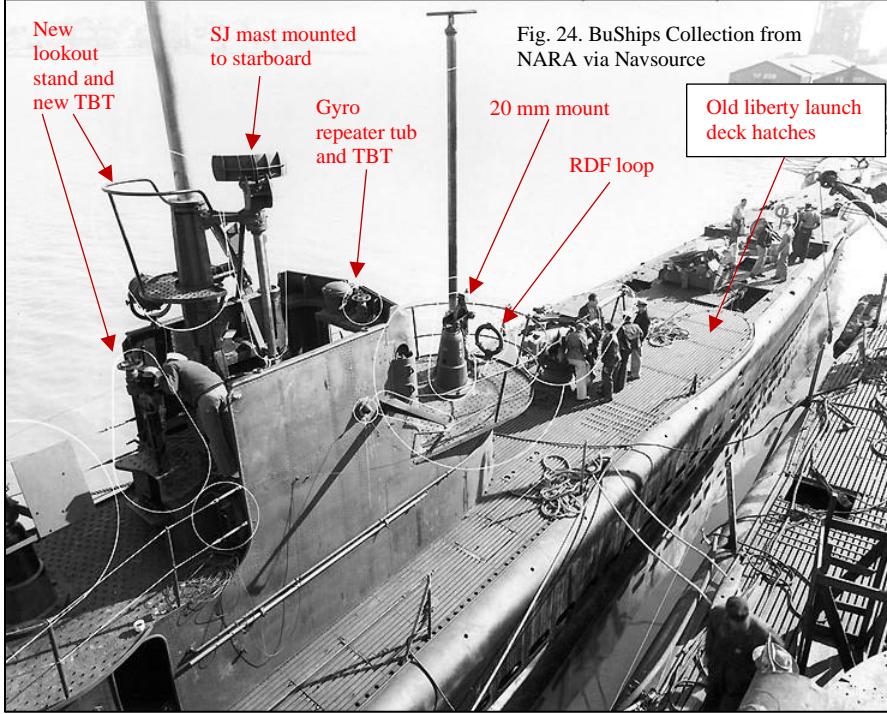


The next step in the modification of these boats involved the further reduction of the topside profile and the installation of more guns. Once the bridge steering station was removed the justification for the bulk of the pilothouse was gone and thus it became a target for removal. Once gone it also



provided another platform for the well liked 20 mm cannon. *Permit* is shown in Figure 23 in January 1943 with her profile reduced to the absolute minimum. The pilothouse has been cut away and a new bulkhead installed just in front of the bridge. The remaining portions of the cigarette deck bulwark have also been removed. A new gun deck forward has been created and a 20 mm

gun on a Mk 5 mount has been installed. The after 20 mm gun has a new dual gun shield installed on the mount to help protect the gunner. The 3"/50 caliber deck gun has been moved to the forward position (all of the *Porpoise* class were built with two deck gun foundations) giving it greater utility in attacking during an approach to the enemy. The SD radar mast stayed in its previous position, required by the set's location in the control room. The mast is raised in this photo. At the bow the downward canted external torpedo tubes can be seen, along with the deck covers just above the bow planes.



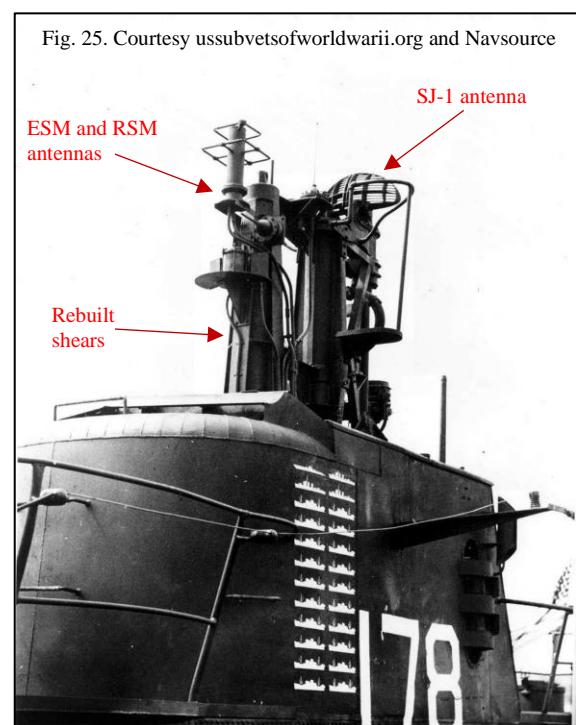
This close-up of *Permit*'s fairwater and bridge (Figure 24) taken at the same time highlights the new configuration. On the left a portion of the guard plate for the aft 20 mm gun can be seen. On the aft end of the bridge the Sailor is bending over the newly installed TBT mount. Above his head is a reconfigured lookout platform attached to the #2 periscope shear, the periscope in this case being fully raised. The SJ mast is seen on the starboard side of the periscopes. Partially

obscured by the SJ mast is the top of the shear for #1 periscope, lower than #2 scope because it still lets into the control room. The persistence of this arrangement is dictated by the small size of the conning tower. There was no room for the Torpedo Data Computer (TDC) in the conning tower so it was installed in the control room. Because of this it was felt that having one of the two periscope eyepieces still in the control room contributed to efficiency of the fire control tracking party. On the newly reconstructed bridge you can see a watertight tub with a hinged cover that encloses a gyro compass repeater and right next to that is another mount for a TBT. Below that on the new bulkhead is a door that opens onto the new gun deck. This facilitated the movement of the gunner to his mount and the door was normally closed unless the gun was manned. The mount is clearly the solid base Mk 5 style and the gun itself is dismounted, normally kept in topside waterproof tubs or taken below while the boat



was submerged. The disadvantage of having the SD mast in this location is obvious here, as it restricts the firing arc of the gun when the mast is raised. Figure 24 is a December 1942 photo of *Pickerel* and it shows this configuration from the reverse angle. *Pickerel* has a new Low Frequency (LF) square-shaped loop antenna mounted on the port side of the shears. The oblong hatches in the slotted deck on *Permit* cover spaces that had been used to store two motor launches. These were used to run liberty parties ashore when the boat was anchored out. The boats were quickly removed once the war began, but the deck hatches remained. These two boats received engine and muffler upgrades similar to *Pike* and thus had the raised platforms on the aft deck. *Porpoise* class boats with this fairwater configuration were equivalent to the *Gato* class Mod 3.

Being older boats with less combat potential than the newer classes, these submarines did not receive some of the upgrades that the newer boats did. In particular most of the surviving *Porpoise* class retained their control room periscope and the stepped appearance of their shears to the end of their lives. An exception is the *Permit*, shown in Figure 25 in November 1945. Her bridge area and shears have been extensively rebuilt. Given the new height of her number 1 periscope shear, it is likely that she has been modified so that both periscope eyepieces let into the conning tower. There are new lookout platforms on either side of the shears and she has been refitted with the more capable SJ-1 surface search radar with the large mesh dish, now mounted aft of the scopes in a fashion similar to the later *Gato*, *Balao*, and *Tench* class boats. The small pencil type horizontal antenna on the front of number 1 scope is the APR-1 Radar Surveillance Measures antenna, which gave the boats a radar detection capability. The larger vertical antenna with the square arrays is an unusual mount, not seen in many photos. It is either a Radio Directional Finder (RDF) antenna, or it is some kind of Electronic Surveillance Measures (ESM) gear.



These boats were not perfect. While the experimentation phase of the V-class was in the past, there were still equipment and doctrinal issues that had yet to be resolved. They suffered from inadequate main armament, unreliable engines (the original Hooven-Owens-Rentschler double acting diesels in *Pompano* proved particularly troublesome), problematic main propulsion electrical systems, and leaky ballast tanks. In spite of these issues (mostly correctable), the boats proved to be great advancements over their V-class brethren and in general were well regarded by their crews and the Submarine Force. They were in the thick of the fight against the Japanese from day one and all of



them made numerous war patrols in enemy waters. The relentless pace of the war was hard on these boats and their brave crews with *Shark*, *Perch*, *Pickerel*, and *Pompano* being lost in combat. The remainder of the boats were all pulled from combat action before the end of the war and sent back to the states for far less strenuous training duty. *Porpoise* and *Pike* with their leaky riveted full double hulls were the first to go, being withdrawn in the late summer of 1943. Once back stateside and engaged in training duties their hull numbers made a reappearance, as shown in Figure 26, a 1944 photo of *Pike* off of Rhode Island. Only boats engaged in training duties stateside carried hull numbers during the war years. Boats in the war zone carried no exterior identification. This will help the researcher place a date and/or rough location of a photo.

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